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# WATER USE EFFICIENCY CASE STUDY

MicroSemi USPD Inc.
Watertown, MA

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| **Water Source: Town of Watertown** | **100%** |
| **Water Use in 1993:** | **19.2 million gallons** |
| **Water Use in 1994:** | **12.6 million gallons projected** |
| **Reduction in Water Use from 1993 to 1994:** | **30 %** |
| **Estimated cost for implementation:** | **$135,000 in 1991-1993** |
| **Estimated water, sewer, and heating savings:** | **$55,600 in 1994** |
| **Increase in Retail Water Rates from 1992 to 1993:** | **14 %** |
| **Increase in Retail Sewer Rates from 1992 to 1993:** | **22 %** |

MicroSemi USPD, Inc. is a manufacturer of semiconductor devices for the electronics industry. The major operations performed at MicroSemi are wafer fabrication involving cleaning, diffusion, photolithographing, cutting, and testing of purchased wafers; and wafer assembly including electroplating, parts cleaning, soldering, and testing of finished wafers.

Formerly named Unitrode, MicroSemi has been operating at the site since 1964. The facility is housed in a 164,000 square foot, 3 story building with a working basement. The facility operates with 2 shifts per day, 5 days per week. There are approximately 280 employees on the first shift and 20 on the second shift.

In 1992, the MWRA conducted a Water Efficiency Study at MicroSemi as part of the Industrial/Commercial/Institutional (ICI) Water Management Program. The purpose of the program was to analyze water use at the facility and identify cost-effective Water Efficiency Measures (WEMs) that when combined would result in a payback on investment of roughly two years. With the assistance of the report provided by the MWRA, MicroSemi was able to implement several water efficiency measures involving good operating practices, equipment substitutions, and water reuse ideas.

Approximately 65% of MicroSemi's water consumption is for the production of high purity water needed for parts rinsing and plating tank makeup. The high purity water is produced at the on-site water treatment system which incorporates ultra filtration (UF), reverse osmosis (RO), and deionization (DI) units. It was determined that the reject streams from the RO and DI units constitute 25% of the 65% of the water allocated to process use. The remaining 35% of the water is used for cooling tower makeup, sanitary purposes, and general cleanup.

The specific measures outlined in the report included:

- Replacing two of the filter membranes in the water purification system,
- Utilizing reject streams from the purification system for cooling tower makeup,
- Reducing non-production period losses, and
- Reducing rinse water consumption in general.

Implementation of some of these measures thus far has resulted in an estimated annual savings of over 5.5 million gallons of water at the facility.

**Water Efficiency Measures**

Two of the measures recommended by the Authority were implemented in the past year and have already saved a considerable amount of water. One of the WEMs included the replacement of the membranes for the UF and RO units in the high purity water treatment system. The total replacement cost for this measure, as outlined in the report, was estimated at $34,000. With estimated water and sewer savings at $42,500, payback for this measure was 0.8 year.

When upper management at MicroSemi realized cost effectiveness of the membrane replacements and also considered the long-term lifecycle benefits, they decided to replace not only the UF and RO units, but upgrade the entire water treatment system. This entailed replacing all pretreatment and process equipment including sand filters, ion exchange units, carbon filters, mixed bed deionization units, particulate filters, ultraviolet treatment, and polishing units. The total implementation cost for the project was $135,000. Although the payback of less than two years was not met in this case, the company used the information they received from the MWRA and authorized the investment on the basis of lifecycle benefits.

Another WEM recommended by the MWRA involved the reduction or elimination of non-production period losses. These losses, which were due to the lack of employee awareness and small leaks, have been virtually eliminated. The major remedy for these non-production period losses was proper education of the employees on the significance of water conservation, and a few inexpensive valve replacements. There was no implementation cost attributed to training employees. Additionally, since the valve replacements were accounted for as normal operational expenses, no monetary investment was required to implement this measure.

Implementation of these two measures was completed in April of 1994. Comparing the water used in 1993 through October to that used during the same time period in 1994, monthly savings have averaged roughly 30% per month or a total of 5,493,000 gallons over the entire period. Savings extrapolated over the year is estimated at 6,592,000 gallons, or $55,600 for water and sewer reductions. At current water and sewer rates, the payback for both measures will be realized in 2.4 years.

**Other Measures**

Since a large portion of MicroSemi's production base has been related to military applications, a recent change in military specifications has necessitated a modification to the plating lines. With this change in product demand an older less efficient line has been replaced by a more modern design. This has contributed to the overall savings in water consumption.

Much of the older equipment that was removed from the water purification system has recently been put to good use. Using the old RO unit, cation/anion system, and some old pumps, one area of the plating process has recently been modified to allow rinse tanks to go through a closed loop system. The initial investment for this measure was quoted at $5,000 and consisted mainly of piping and electrical hookups. The net water savings from this measure is estimated at 10 gallons/minute or a projected 1.2 million gallons over the next year.

The facility manager at MicroSemi is currently in the process of implementing another WEM. This proposed measure, also suggested by the Authority, will involve reusing the RO and UF reject water for cooling tower makeup. If this measure is approved, an additional annual savings of 657,000 gallons or $5,500 could be realized.

**Summary**

The MWRA's water management plans and water use surveys provide a two-fold service: to present facility managers with solutions for efficient water use, and to demonstrate a cost/savings analysis of the measures outlined in the reports for evaluation by management in budget planning.

MicroSemi is an example of a company that has benefited from the ICI Water Efficiency Program. When the facility manager became aware of how much water was allocated to the different uses in the facility, the efficiency projects could be justified based on actual gallons saved. In this case, once corporate management was made aware of the potential savings in water and sewer costs from the replacement of the RO and UF units, they decided to take the necessary steps to replace the entire water treatment system.

The great success at MicroSemi could not have been achieved without the ambition and technical expertise of the facility manager George Smith, P.E. He is responsible for facilitating the measures suggested by the MWRA and initiating the actual savings being made today.

Identifying water saving opportunities and improving the efficiency of daily operations at a facility can sometimes be accomplished more easily with the help of an outside consultant who can focus only on water use and cost benefits. A specialized consultant also has the advantage of working in similar facilities as well as knowledge from past experiences. Changes that were made to eliminate non-production losses were not difficult to implement. The MWRA offered a specific approach to MicroSemi's overall operations that identified opportunities and presented solutions to optimize water use. With this information MicroSemi has implemented an outstanding plan for water efficiency.